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P01/7700 0.00-0220608.4

Request for grant of a patent

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Your reference	SEP02RPA
Patent application number *(The Patent Office will fill in this part)*	05 SEP 2002 0220608.4
Full name, address and postcode of the or of each applicant *(underline all surnames)*	MAURICE CLIFFORD HATELY 4 REDWOOD CRESCENT INVERNESS IV2 6HB
Patents ADP number *(if you know it)*	0829741600 2
If the applicant is a corporate body, give the country/state of its incorporation	
Title of the invention	RADIO PHOTON ANTENNAS
Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	KINGS PATENT AGENCY LTD 73 FARRINGDON ROAD LONDON EC1M 3JQ
Patents ADP number *(if you know it)*	0000100800 1

If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
U.K.	0208527.2	13 APR 02

If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
2 215 524 B	27/1/89
2 330 695 B	30/8/97

Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

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Continuation sheets of this form	
Description	7
Claim(s)	3
Abstract	–
Drawing(s)	5 + 5

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Priority documents	
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/~~We~~ request the grant of a patent on the basis of this application

Signature M C Hately Date 4/9/02

12. Name and daytime telephone number of person to contact in the United Kingdom MR. M.C. HATELY 01463 772 169

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RADIO PHOTON ANTENNAS

The techniques which are disclosed in this document concern developments of the Crossed Field Antennas originally described in patents GB 2 215 524 B and GB 2 330 695 A . In these earlier applications the power to be transmitted is divided into two parts and the two half powers are used to separately drive field stimulators one of which generates radio frequency electric field lines E and the other half power generates radio frequency magnetic field lines H. In order to create radio waves by analogy with the Poynting Vector theory of the radio wave the said field lines may be thought of in terms of Quantum Mechanics as the basic virtual photons of the two energies. In order to compose real photons which can fly away with the total energy as an expanding as a powerful spherical radio wavefront at the velocity of light the following criteria must be observed; the two sets of field lines must be :-

a) crossed geometrically at right angles with the correct spin for outward motion
b) applied in the same volume of space called the interaction zone
c) scaled so that half the power is in each field
d) proportioned so that the ratio E/H equals the impedance of space
e) synchronised in time with zero phase error
f) of the same curvature

When these essential criteria are fulfilled radio waves are formed all around the field stimulators which may be very small in dimensions compared with a wavelength. Dimensions of 2 or 3 percent of the wavelength have been found to be entirely suitable for creating radio antennas of this type which are highly efficient. Unfortunately the conventional wisdom which states that an antenna must have a significant physical size compared with the half-wavelength in order to be efficient, has retarded the understanding and acceptance of the

crossed field antennas made according to the said earlier patents. The achievement of success with the crossed field antennas so far disclosed has necessitated the incorporation of quite elaborate arrangements to ensure continuous synchronism because the process of moving from RF current flow to magnetic field H includes a process of mathematical differentiation which brings in a 90 degree phase advance. Thus the earlier arrangements of these devices had to involve some scheme for arranging that the currents flowing to the stimulators passed through system to cause a plus and minus 45 degree separation. The experience of working with the crossed field antenna for more than a decade has enabled the present inventor to realise that the 90 degree phase difference is a natural feature of the resonant electrical circuit so, if therefore a single resonant circuit could be arranged to stimulate the two fields required to create the radio waves it would be very easy to phase up a crossed field antenna by merely adjusting the resonant frequency to the transmit frequency. Experiments have shown that success is achieved when the low impedance feed current to the high voltage resonating autotransformer is passed via coils placed around in the space above the ground plane connected in parallel so that their reactance is low at the frequency of operation. As this type of antenna is so small, the inventor is recommending that the generic name Radio Photon Antenna be given to this design.

The basic Radio Photon Antenna is shown in the Figures 1 A 1B and 1C. Figure 1A is a cross-sectioned elevation of the device, showing the construction. The radio frequency power for the antenna enters via a low impedance coaxial feeder cable 1 whose screen is connected electrically to the metal ground plane 2 and whose inner conductor caries the current into the several insulated sections of the N toroidal coils 3 A to D (not containing any magnetic material) lying horizontal but insulated from the other parts being eventually

connected after totalling some 10 to 50 turns to both the topmost hollow non-magnetic metal cylinder 4 which is the electric field stimulator with a similar telescopic trimming section 5A or a trimmer capacitor 5B which may be mounted anywhere convenient and used to adjust the parallel resonant circuit of the resonator autotransformer 5C and the total capacitance of the cylinder and/or trimmer capacitor to the frequency to be transmitted. Figure 1B is a plan view of the antenna. The non-magnetic terminating plane 2 is in size typically 2.5 percent of a wavelength in dimension and may be square or circular. Its purpose is to capture the lower ends of the myriad population of E field lines travelling from the outer surface of the cylinder called the E-plate which in the field directions at the moment of the cycle shown for study is E-plate at its positive peak voltage in the field path theoretical diagram Figure 1C, electric field lines E are severally marked 6 and cut across the magnetic field lines H which are severally marked 7 and result in a vast population of photons leaving the antenna on all sides of which just two are shown by arrows marked severally S. The dimensions of the E-plate may be scaled from the appearance of the dimensions of the Figures 1A and 1B bearing in mind that the E field lines are to cut the magnetic field lines H circling in a myriad haze above the ground plane with comparable curvatures.

The interaction zone is therefore most of the space between the ground plane and the E-plate cylinder and the radio power flow S is outwards from the interaction zone all around. Thus this antenna is ideal for omnidirectional radiation of vertically polarised radio waves as would be required for broadcasting.

What is particularly advantageous in this form of antenna is that the phasing is obtained automatically with the adjustment to resonance of a single tuned circuit. It will be recalled that the earlier designs required two resonance circuits to be adjusted to be slightly off-tune

so the 90 degree phase change can be composed by use of the plus and minus 45 phase error native to the off-tune inductive-capacitive resonant circuits. Operators found the adjustment to their optimum of the said dual off-sets extremely difficult to perform.

Figure 2A shows a developed form of Radio Photon Antenna in which two modifications are incorporated in order to give more freedom to the designer and therefore better efficiency and wider bandwidth. The metal E-plate is now constructed in a conical form 8 so that its capacity to the ground plane is greater than that of the cylinder type and the electric field lines' curvature are more uniformly comparable to the magnetic lines, mounted on insulated pillars 9 allowing for adjustment of the capacity of the E-plate and hence of the resonant frequency. Also there is shown a resonator coil 10 mounted vertically within the conical E-plate.

This feed produces the said freedom for the designer to optimise input impedance but it also makes the voltage on the E-plate positive at the time of the cycle for study: see the field analysis diagram Figure 2B. The current I from the transformer being high impedance comparable in magnitude at resonance to the feed current I/N flowing in each of the N feeds being summed to the to the tap on the resonator coil is large and in phase with the E-plate voltage.

When the radiation commences both of the above forms of the Radio Photon Antenna experience their tuned circuit become more heavily damped by the extra loss of the energy to space. They therefore have a reduction in voltage and current automatically producing benign bandwidth behaviour. Should a balanced antenna giving horizontal polarisation be required the design of Figure 3 may be used. Here the balanced feeder 11 is connected across a few turns at the back portion of the resonator coil 12 shown within the sectioned diagram and the near-ends of the said coil used for connection to the two conical E-

plates marked +V and -V and to which the trimmer capacitor 13 is attached.

Moving on to incorporate the ideas disclosed here for use in the antennas of the dual conductor systems disclosed in patent GB 2 330 695 A one may recall that these antennas relied upon interaction of an RF electric field emanating from the surface of one conductor and the RF magnetic field caused by the nearby current carrying conductor. Figure 4A copied from the said patent shows the equivalent circuit of the head unit and explains how the oppositely connected series resonant circuits have their working parts displaced in the loop so that the necessary interaction of E and H fields can occur and the Poynting vector be synthesised. Feeder 14 brings the power from the transmitter on the ground to the head unit via socket 15 and thence to split point 16 directly, or via a transformer 17, Figure 4B copied from the above mentioned patent shows the actual layout of the conductors being in dimensions typically just 1 percent of a wavelength in diameter. The two resonance circuits are fed from the said split point and are adjusted in manufacture by trimmer capacitors C1 and C2 in series with the inductances L1 and L2 of the two loop conductors. And Figure 4C similarly shows the physical construction of the coaxial form of dual conductor loop head unit.

As with the earlier crossed field antennas in the dual loop crossed field antenna, in order to obtain the necessary 90 degree phase difference in the current producing the magnetic field and the voltage from the conductor providing the electric field then the resonant circuits have to be slightly off-tuned in order to give plus and minus 45 degrees and thence the total 90 degrees. As will be shown below when the concept of the present disclosure is employed, the complex alignment procedure mentioned above becomes unnecessary. There is now just one single tuned circuit to be resonated, a circuit which on

adjustment becomes the sole and exact source of the 90 degree phase difference.

Figure 5 shows the physical construction of the head unit of the Loop form of the Radio Photon Antenna. The power arrives from the transmitter via a coaxial feeder (not shown) and is connected at the socket 18. The diameter of the coaxial loop 19 is typically about 1 percent of the radiated wavelength. The circuit components for the phasing resonator are contained within a waterproof enclosure 20 and consist of a voltage step-up autotransformer 21 wound on an iron-dust or ferrite core resonated by the capacitor 23 connected to the outer screen 19 from which the electric field lines flow outwards. The inner conductor 22 of the loop carries the current from the feeder socket 18 flows to the input tap on the resonator transformer 21.

Adjustment of the number of turns and the size of the loop and the trimmer capacitor will enable the designer to obtain resonance at any desired frequency in the whole radio spectrum. The loop may be mounted either horizontally as in Figure 6 or vertically as in Figure 7.

Tasks for which the Radio Photon Loop Antenna is specially recommended include communications from mobiles such as aircraft, ships, satellites, personal telephones, aerials of minimal visual impact, but also covert and clandestine fixed stations.

All the antennas disclosed in this application, like all known radio aerials, are reciprocal in behaviour; in other words they will receive and transmit radio signals with excellent efficiency. The signals captured by these antennas are entirely comparable with those received by antennas of the conventional half-wave dipole design and they are

therefore ideal for use with transceiver equipment. It is at this time opportune to say that the concept of aerial aperture has little meaning for Radio Photon Antennas except to say that these devices must be reciprocal in a new sense i.e. that of emitting or capturing photons. It is therefore felt to be entirely justified to name these devices and their developed forms a "Radio Photon Antennas".

CLAIMS:-

1 A radio antenna which is physically less than 10 percent of a wavelength in size in which the power to be transmitted is conducted into two reactive components of inductive and capacitive nature in resonance the first component being used to stimulate the principal in phase radio-frequency magnetic field and the second component being used to stimulate the principal radio-frequency electric field and the said two fields being placed so as to cross stress the space surrounding the antenna called the interaction zone and designed with careful attention in construction so that five of the six essential criteria of Poynting vector synthesis can be achieved it being a natural feature of the resonant circuit that the electric field is in phase with the potential upon the capacitive stimulator but in the said circuit the current fed to the resonant transformer being directed through parallel parts of a toroidal coil in order to stimulate the necessary in phase magnetic field thus resolving the necessary final criterion of in-phase electrical alternation of electric and magnetic fields.

2 A radio antenna according to Claim 1 which has an electric field stimulator which is a hollow cylinder with or without a sliding telescoping section within held vertically above a toroidal magnetic stimulator mounted horizontally above a non-magnetic metal plane with its end connections connected to the said E-plate and the plane with or without a trimmer capacitor connected in parallel across the resonator coil.

3 A radio antenna according to Claims 1 and 2 with the electric field stimulator constructed as a hollow cone which is able to be moved so as to adjust its electrical capacity to the said terminating plane.

4 A radio antenna according to Claims 1 and 2 or 3 in which the

electric field stimulator or the non-magnetic plane are shaped to apply the said field in a special manner to produce non uniformly directed radiation.

5 A radio antenna according to Claim 1 with any or all of the constructional features given in Claims 2 to 4 used to enhance the efficiency of the antenna as a radiator of radio frequency power in any particular aspect.

6 A radio antenna according to Claim 1 in which the electric field stimulated by a loop conductor and the magnetic field is stimulated by a second loop conductor located in close proximity.

7 A radio antenna according to Claims 1 and 5 in which the conductors are firstly the outer screen and secondly the inner conductor of a loop of coaxial cable.

8 A radio antenna according to Claims 1 and 5 in which more than one turn is used for either or both of the said conductor loops.

9 A radio antenna according to any of the Claims 1 to 8 used in conjunction with a conducting sheet or mesh of any shape held in a position designed to obstruct radiation in an unwanted direction or to improve radiation by reflection in a preferred direction, or directions.

10 A radio antenna according to any of the Claims 1 to 9 which has a remotely controlled trimmer capacitor in order to vary the frequency of operation from a distance.

11 A radio antenna which is composed of a two or more individual antennas according to any of the Claims 1 to 7 which are arranged to interact so as to produce a shaped pattern of directivity as in the previously known science of phased arrays.

12 A radio antenna according to any of the Claims 1 to 11 being located near other metal rods or arrays of such conductors in order to parasitically affect the radiation in directivity as in the previously known science of parasitic arrays.

13 A radio antenna according to any of the Claims 1 to 8 located at the focus of a parabolic reflector whether fixed or steerable for enhancement of transmission or reception in a designed direction or directions

14 A radio antenna according to any of the above claims 1 to 13 used for any purpose be it civilian or military or cultural in communications whether for two way wireless telegraphy (in the legal sense of data, telephone, television, navigational, broadcasting radar, homing, tracking etc) one way transmission or reception where the user is human or automatic located in any fixed location or mobile platform on above or under land, sea, or in the air or space.

15 A radio antenna according to any of the above Claims 1 to 14 used for any industrial or medical or research purpose such as nuclear fusion, radio therapy, radio astronomy, locating buried ordinance, cable location, security observation, pest extermination, crop stimulation or cleaning or any other agricultural procedure.

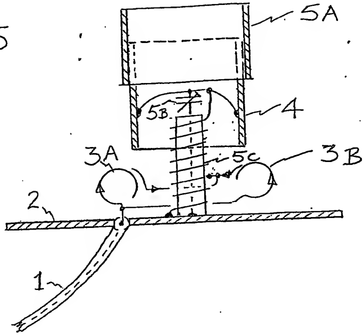

FIG 1A

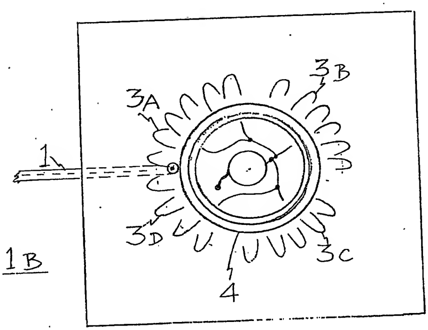

FIG 1B

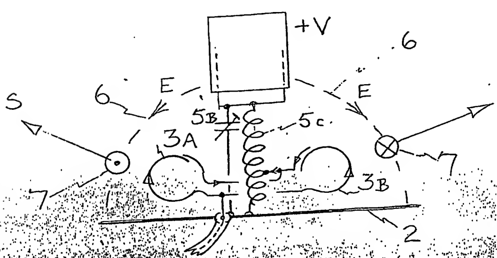

FIG 1C

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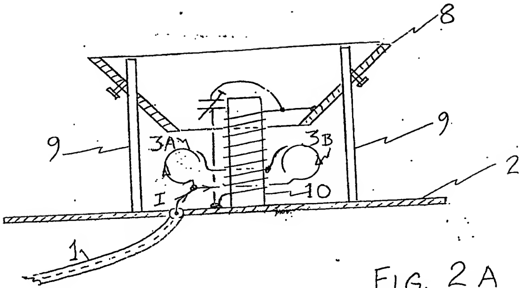
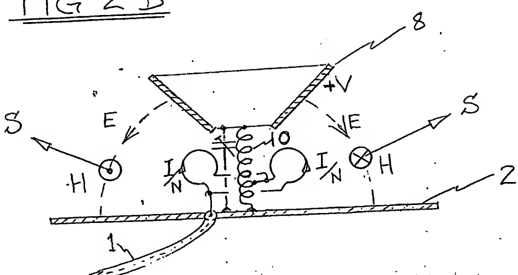


FIG. 2A

FIG 2B



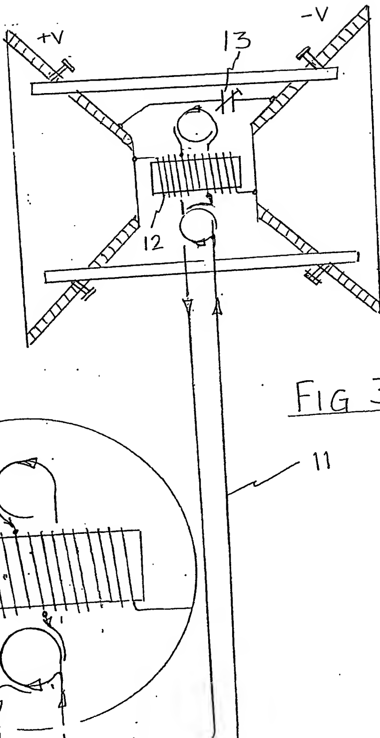


FIG 3A

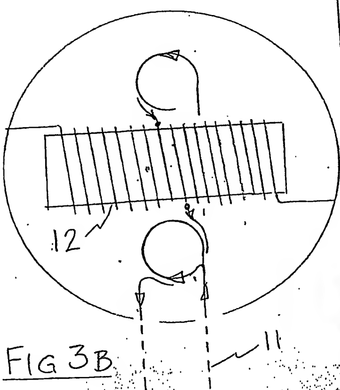


FIG 3B

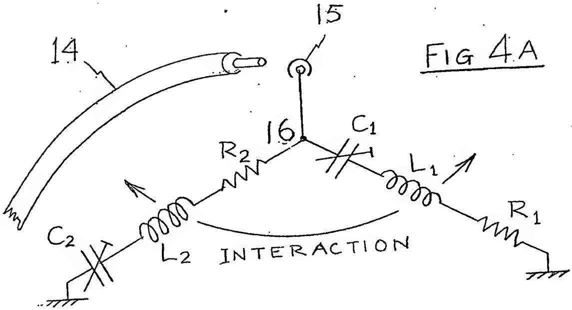


FIG 4A

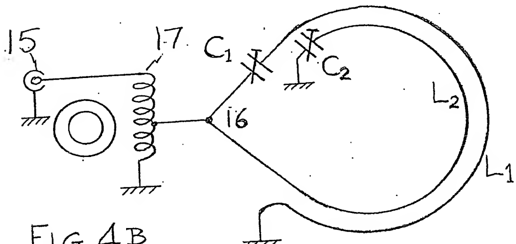


FIG 4B

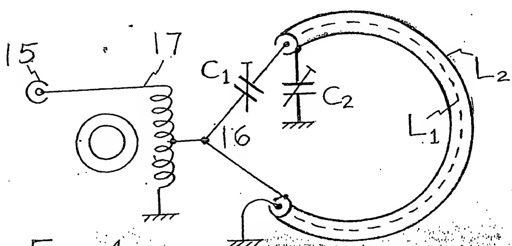


FIG 4C

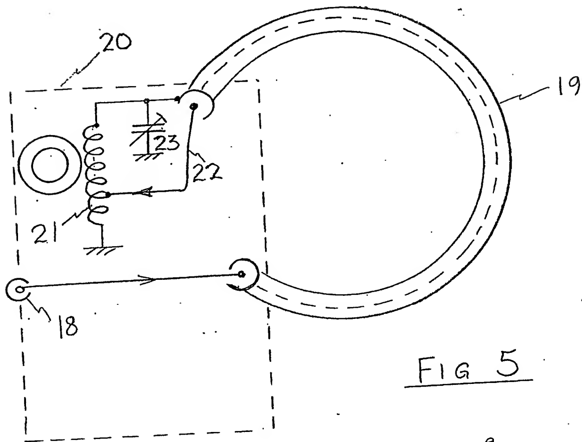


FIG 5

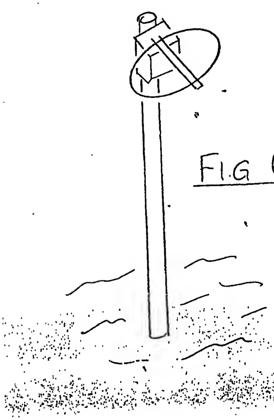


FIG 6

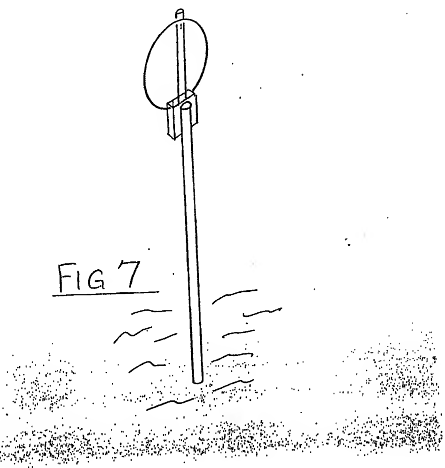


FIG 7